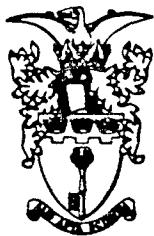


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ROYAL AIRCRAFT ESTABLISHMENT

Technical Report 84050

May 1984

**THE APPLICATION OF
ANTHROPOMETRIC SURVEY DATA TO
AIRCREW CLOTHING SIZING**

by

Judy E. Aplin

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THE APPLICATION OF ANTHROPOMETRIC SURVEY DATA TO
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SUMMARY

Since completion of the 1970/71 anthropometric survey of 2000 Royal Air Force aircrew, the Protective Equipment Section of Flight Systems (Farnborough) Department has made full use of the acquired data to support its advisory role on aircrew protective clothing sizing. Computer analysis of the data has been undertaken to provide sizing information relevant to a variety of garment types and numerically different size-rolls.

This Report outlines the general approach adopted for the sizing of body-cover garments and headgear. The influences of the choice of control dimensions and subsidiary measurement range limitation upon the size-rolls for aircrew one-piece coverall type garments are discussed.

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1 INTRODUCTION

The UK anthropometric survey of 2000 Royal Air Force aircrew in 1970/71¹ was undertaken to fulfil an urgent need for up-to-date and comprehensive data on the body measurements of the then current Royal Air Force aircrew population. These data were required for application to aircrew protective clothing sizing and to aircraft workspace studies. Since 1971 the data have been used extensively by the Protective Equipment Section of Flight Systems (Farnborough) Department, Royal Aircraft Establishment, to provide guidance to Industry and other Government agencies on aircrew protective clothing sizing and to support in-house clothing research and development. Computation and analysis of sizing data have been undertaken for a range of types of protective clothing and equipment, including protective headgear². Specific garments sized by the direct application of the 1970/71 survey results to date are:-

Coverall Aircrew Mk 14A	}	currently in-service
Coverall Inner Aircrew NBC Mk 1		
Coverall Inner Aircrew Immersion	}	currently undergoing final
Coverall Inner Aircrew Knitted Mk 1		assessments
Coverall Aircrew Type 16		
Trousers External Anti-g	-	undergoing re-development and re-sizing
Life-preserver Mk 28	-	a re-sized and modified version of the earlier Mks of sleeved life-preservers
Liquid conditioned coverall	-	an experimental garment.

Whilst data interpretation and manipulation varies for the differing types of protective equipment, a common basic statistical approach is adopted to define the measurements upon which the size-rolls of body-cover garments, headgear, etc are based. This paper outlines the statistical approach to protective clothing sizing adopted by FS(F) Department, RAE, with particular reference to one-piece body cover garments of the aircrew coverall type. By way of example, data are presented which define the body measurement ranges appropriate to a nine size garment coverage of approximately 90% of the aircrew population.

In the early stages of the garment sizing programmes, reservations were held regarding the adequacy of the information provided to the clothing designer in meeting the basic needs for the pattern drafting. Particular areas of concern were the absence of some conventional tailoring measurements, the need to interpret anthropometric data into equivalent tailoring data and the need on the part of the designer to depart from accustomed approaches to the construction and size grading of patterns. In practice these early reservations have proved unfounded and with a sound understanding of the requirements, and a minimum of subsequent queries, the clothing designer has produced the necessary patterns from which garments fully meeting the predicted subject fitting standards have been produced.

2 SURVEY SAMPLE AND MEASUREMENT DEFINITION

The anthropometric survey sample, upon which the data presented in this Report are based, consisted of 2000 male Royal Air Force aircrew including all ranks below Group Captain and with ages ranging from 18 to 45 years. The composition of the 1970/71 aircrew population was determined with respect to age, crew duty and operational role. The stations at which the aircrew were measured were chosen to give a sample representative of the whole for these categories. The resulting sample consisted of 1028 pilots, 613 navigators and 359 other flight deck aircrew.

For the definition of the body measurements to which this paper relates reference should be made to RAE Technical Report 73083¹ in which all measurements are described and all measuring techniques are illustrated. For the survey all measured subjects wore only a standard pattern of continental briefs in stretch nylon, thus, effectively, all measurements related to the nude body.

3 SIZING PROGRAMME DETAILS

The statistical approach adopted for the sizing programme outlined in this paper involves the selection of two control dimensions and the division of the aircrew population into sub-groups defined by discrete ranges of these control dimensions. In practice the population coverage is generally less than 100% and it is accepted that a proportion of subjects will require 'special-measure' garments to sizes which fall outside the size-roll range. Exceptions to this practice do arise, however, when considering relatively complex protective headgear, NBC headgear, etc where full coverage of the population is required and the penalties of having to provide special measure items are unacceptable.

The sub-groups of the population defined by the discrete ranges of the control dimensions are processed separately to provide, for each group, statistical data on all subsidiary measurements of relevance to garment size definition. These data are then analysed and measurements are selected for each population sub-group, upon which the sizing of each garment in the size roll is based.

3.1 Selection of control dimensions

Body garment size roll determination normally involves the use of two control dimensions, selected such that each will separately reflect variable body features of importance to the clothing designer, such as lengths and mass. The choice of control dimensions upon which a clothing sizing programme should be based depends on a number of factors such as:

- (a) The measurements upon which the clothing designer requires the greatest degree of control.
- (b) The need to adopt control dimensions which correlate well with other related dimensions, eg chest circumference with waist circumference and buttock circumference, and stature with leg length (crotch height), cervical height and arm length (axilla to wrist).

(A selection of some relevant correlation coefficients of typical control dimensions and subsidiary dimensions from the UK 2000 aircrew anthropometric survey is given at Table 1.)

- (c) Ease and accuracy with which the measurements can be taken on the subject and need for familiarity of the subject with his control dimensions for clothing issue purposes.
- (d) Previously adopted control dimensions used for the sizing of other items of clothing which form part of the proposed aircrew equipment assembly (AEA). Ideally all clothing items which, on the layer principle, form an integrated AEA should be sized to the same control dimensions and be based on the same or compatible control dimension sub-ranges.

In meeting the selection criteria at (a) to (d) above there is only a limited control dimension choice when considering one-piece coverall type garments.

As far as the length dimensions are concerned there is merit from the pattern drafter's point of view in using cervical height as a control dimension: this however, would not meet selection factors (c) and (d) above. With cervical height and stature having a correlation coefficient of 0.975 the obvious choice for a length control dimension is stature.

The choice of control dimension to reflect body mass, ie circumferences, depths, breadths, is however not so obvious.

For specific garment sizing, weight, chest circumference and vertical trunk circumference have each been considered and investigated by RAE FS(F) Department. This work was undertaken in 1967 and based on very limited data obtained from a preliminary anthropometric survey on only 200 Royal Air Force and Royal Navy aircrew³. The shortcomings of this preliminary work on clothing sizing control dimensions due to the small population sample involved and the problem of obtaining meaningful data from population sub-groups which differ for each sizing approach are fully appreciated. However, the RAE findings lend broad support to the findings of other workers in this field^{4,5} that, in theory, the control dimensions of stature and weight provide the best compromise approach for the sizing of one-piece coverall type garments.

One practical disadvantage of this approach, however, is the relatively poor control over chest circumference. To meet sartorial and functional needs, close control of garment chest circumference is considered to be of major importance, not least because of the adverse effects of excess garment girth in this region upon scye position and sleeve fit.

Although weight and chest circumference have a correlation coefficient of 0.858, recent study⁵ has shown in practical garment sizing terms the 5th to 95th percentile range of chest circumference within any of the discrete population sub-groups appropriate to a nine size roll is of the order of 10.5 cm. The garments must be sized to fit the larger subjects and have, typically, a 10 to 13 cm circumferential excess over the nude chest girth of these subjects to accommodate the bulk of the maximum number of undergarments

likely to be worn. It thus follows that the lower percentile subjects can be penalised with a garment chest circumference excess of up to 23.5 cm when wearing minimal layers beneath, should no alternative smaller chest size garment covering an appropriate stature range be available.

If virtually the full range of subsidiary measurements is to be accommodated, as suggested elsewhere in this paper, the lower percentile chest circumference subjects, in some garment sizes, can be penalised in this way with an excess garment girth at the chest of up to 34.5 cm.

This practical consideration supported a decision by the UK aircrew equipment procurement authorities that the potential advantages of stature/weight control for aircrew clothing sizing were insufficient to outweigh the problems associated with a major departure from the long established use of stature and chest circumference as garment sizing controls. Thus, in the sizing programmes undertaken by RAE FS(F) Department to which this paper refers, stature and chest circumference have been retained as control dimensions.

3.2 Selection of control dimension intervals

The choice of control dimension intervals will depend on such factors as:

- (a) The standard of garment fit required.
- (b) The logistic disadvantages of a large number of garment sizes.
- (c) The disadvantages of having to provide 'special measure' garments for those subjects not accommodated by the size-roll garments.
- (d) The degree of adjustment of control dimension related measurements which can be provided in the garment design.
- (e) To some extent, the selected garment fabric.

Computer analysis of the anthropometric data has demonstrated that the selection of small control dimension intervals does not necessarily reduce the ranges of the subsidiary measurements which each size of garment must accommodate. Table 2 gives the dimensional spans of several subsidiary measurements from size-rolls of different number based on chest circumference and stature as the control dimensions, and shows that increasing the number of sizes would not facilitate a closer fit overall.

In practice, UK experience over some years has indicated that for conventional aircrew coveralls a very satisfactory compromise to the considerations at 3.2(a) to (c) above can be obtained by basing the garment sizing on control dimension intervals of 8 cm for stature and 8 cm for chest circumference.

There is little that can be done in aircrew coverall design to cater for in-built dimensional adjustment which would allow the use of coarser control intervals, apart possibly from the waist circumference, ((d) above), and little scope for incorporating extensible or elasticated fabrics ((e) above) which could serve the same purpose on girth dimensions.

The degree of population coverage required by size-roll garments depends to a large extent on the logistics and cost of providing 'special-measure' garments for subjects not accommodated by the size-roll. To conform with previously established practice the sizing programmes for the Coverall Aircrew Type 16 and for the in-service Coverall Aircrew Mk 14a and Coverall Inner Aircrew NBC Mk 1 adopted a nine size roll. The distribution of the garment sizing grids on the stature/chest circumference scatter plot for the 2000 RAF survey subjects is given at Fig 1. This grid distribution provides a theoretical coverage of about 90% of the survey population but in practice has been shown to give significantly better coverage, presumably because aircrew outside the grid coverage accept a less than ideal garment fit. Reference to Fig 1 indicates that, with the pre-determined 8 cm control dimension intervals applied, theoretical coverage of about 98% of the population would virtually double the number of garment sizes required.

3.3 Subsidiary measurement data

The subsidiary body measurements upon which statistical data were obtained for the RAE FS(F) Department aircrew clothing sizing programmes are listed at Table 3 and the effect upon the ranges of some of them resulting from the selection of different pairs of control parameters is given at Table 4. Tables 5 to 13 inclusive give the statistical data for each of the population sub-groups defined by the nine size-roll control dimension intervals. In the choice of subsidiary measurement ranges upon which to base the nine sizes of garment the designer is given some latitude by the method of presentation of the size-roll data at Tables 5 to 13.

As referred to at section 3.2, approximately 10% of the 2000 RAF survey population are theoretically not accommodated by the nine size-roll population sub-groups defined by the sizing grids at Fig 1. If exclusion of further subjects from the size-roll is undesirable, the clothing designer must cater for accommodation of the full range of each subsidiary measurement. The specimen size-roll data at Tables 5 to 13 does however allow a choice of subsidiary measurement range, covering 100%, 1st to 99th percentile, 2nd to 98th percentile, 3rd to 97th percentile, 4th to 96th percentile, 5th to 95th percentile, 10th to 90th percentile, or ranges between any of these lower and upper percentiles. To provide the means for exclusion only of individuals whose extreme measurements could, if included, grossly influence the garment sizing (and thus the garment fit for the other subjects within each sub-group) data are also presented which cover the second, third and fourth smallest measurements recorded (minimum +1, minimum +2, etc) and the second, third and fourth largest measurements recorded (maximum -1, maximum -2, etc). The number of subjects to whom these individual data apply is also given.

The subsidiary measurement range choice alternatively may be based on values determined from the measurement mean and the standard deviation (SD). Where there is a Normal (Gaussian) distribution the following approximations apply:

Mean ± 1.00 SD = 84th to 16th percentile
Mean ± 1.28 SD = 90th to 10th percentile
Mean ± 1.50 SD = 93rd to 7th percentile
Mean ± 1.65 SD = 95th to 5th percentile
Mean ± 2.33 SD = 99th to 1st percentile.

Note 1: Care must be exercised in this latter approach as the population sub-group data presented at Tables 5 to 13 include some distributions which are significantly skewed.

Note 2: The percentile values given at Tables 5 to 13 have been derived by linear interpolation between successive measured values.

There are arguments for and against adopting a restricted subsidiary measurement range, the prime theoretical advantage of range restriction being the provision of better fitting garments over the restricted ranges of subjects. Whilst this, in theory, is a worthwhile aim, with excluded subjects being eligible for equally well fitting 'special-measure' garments, the law of the Stores Issue Counter will inevitably dictate that many of these 'excluded' subjects become 'included', with resulting malfitting garments.

Measurement range limitation has most significance when applied to the upper percentile range because it dictates that subjects having subsidiary measurements above the upper limiting values, upon which the garment sizing is based, will theoretically be excluded. Limits applied to the lower percentile ranges of subsidiary dimensions are of less importance because subjects having measurements below the cut-off limits will at least be able to fit in their appropriate size of garment, as defined by their control dimension sizes, albeit with an inferior standard of garment fit. The lower percentile ranges are however important when considering such coverall design features as waist adjustment, sleeve cuff adjustment fittings, etc where it is prudent to ensure accommodation of the smallest subject dimensions likely to be fitted by the garments rather than those dictated by lower measurement range limits.

From the above it is implied that if the garment sizing criteria are to be based on limited subsidiary measurement ranges, to have the desired effect the limits should be applied only to the upper percentile ranges when considering one-piece coverall type garments.

In considering subsidiary measurement range restriction it is perhaps worth emphasising the resultant effect of applying, say a "minimum to 95th percentile" limit progressively to just twelve subsidiary measurements. Table 14 indicates the percentage of subjects, nominally fulfilling the stature and chest circumference requirements of the sub-group at size 5 of Fig 1, which would theoretically be excluded from that size by the progressive application of a "minimum to 95th percentile" limit to only twelve of the subsidiary body measurements of interest to the clothing designer. This Table amply illustrates the potential penalties of applying a constant, relatively large (5 percentile) cut-off to all subsidiary measurements.

Although some 'non-accommodated' subjects will be satisfactorily fitted by a change from their nominal garment size and others will accept an inferior garment fit, the percentage of the total aircrew population requiring 'special-measure' garments is likely to be unacceptable. It is the view of the author that subsidiary measurement range limitation should be kept to the minimum consistent with the exclusion of isolated extreme measurements which would dictate significant garment size increase for insignificant benefits in terms of population coverage. There are advantages in avoiding the application of a common percentile range limit to all measurements and to adopting discretionary limits which vary depending upon the importance of each measurement to the garment sizing. With some subsidiary measurements there is very little to be gained by applying any range limitation.

4 APPLICATION OF THE DATA TO THE SIZING OF GARMENTS

From the statistical data presented at Tables 5 to 13 specific body dimensions can be extracted to provide guidance to the clothing designer on the sizing of each size-roll garment. The data selected will depend upon the particular sizing approach adopted, particularly in relation to the degree of subsidiary measurement range limitation deemed acceptable. The very restricted range limitation adopted for the RAE FS(F) Department sizing programmes has resulted in garment size-rolls which have adequately met the predicted sizing and population coverage requirements, without the imposition of unacceptable penalties on the lower percentile subjects in each size group.

Garment fit is influenced significantly by the dimensional clearances allowed between body and garment, thus well considered factors must be applied to the design data extracted from Tables 5 to 13 to define the actual garment sizes. It is important for these factors to take into account the bulk of any underlying garments such that in a 'family' of garments which constitute an AEA there are progressively increasing clearances on garments worn from the body outwards.

The designer's individual approach to data interpretation and the techniques used to ensure embodiment of the stipulated dimensions in the pattern drafts of each garment size are outside the scope of this paper. However, experience has shown that these involve relatively major changes to established tailoring pattern drafting techniques, particularly in relation to the meeting of defined vertical trunk circumference requirements. Changes are also required to the conventional pattern size grading approaches. These, particularly for girth dimensions, generally assume constant proportional size increases for ascending garment sizes. For example, typically the male waist circumference is assumed to be equal to chest circumference minus 4 inches (10.16 cm) and buttock (seat) circumference is assumed to be equal to chest circumference plus 2 inches (5.08 cm). These assumed relationships are shown superimposed on appropriate scatter plots of the 2000 RAF aircrew survey data at Figs 2 and 3 which also graphically illustrate the wide ranges of waist circumference and buttock circumference relevant to any specific value of chest circumference. Figs 2 and 3 and their equivalents for other paired body dimensions⁶ highlight the overriding problem of human body variability which faces those engaged in non-bespoke military garment sizing.

Acknowledgments

The author gratefully acknowledges the assistance given in the preparation of Tables 5 to 11 by Mrs V.A. Roskilly (RAF FS(F)4 Division) and the contribution of Mr C. Leeks on data computation. Acknowledgment must also be made of the contribution of Mr Ron Williams of Beaufort Air-Sea Equipment Ltd who has so willingly cooperated in system proving and the production of patterns and garments to the data provided by RAE FS(F) Department.

Table 1CORRELATION COEFFICIENTS FOR TYPICAL CONTROL DIMENSIONS AND SUBSIDIARY DIMENSIONS

	Weight	Chest circumference	Vertical trunk circumference	Stature
Weight	-	0.858	0.838	0.519
Stature	0.519	0.246	0.637	-
Chest circumference	0.858	-	0.662	0.246
Waist circumference	0.830	0.850	0.632	0.181
Buttock circumference	0.928	0.799	0.773	0.395
Thigh circumference	0.874	0.739	0.669	0.267
Ankle circumference	0.677	0.476	0.539	0.355
Wrist circumference	0.650	0.536	0.554	0.278
Calf circumference	0.746	0.593	0.543	0.239
Vertical trunk circumference	0.838	0.662	-	0.637
Biacromial breadth	0.482	0.446	0.403	0.375
Shoulder breadth	0.773	0.759	0.631	0.364
Cervical height	0.537	0.281	0.639	0.975
Shoulder height	0.546	0.281	0.649	0.978
Waist height	0.464	0.239	0.487	0.881
Crotch height	0.359	0.148	0.344	0.880
Cervical to axilla	0.372	0.307	0.352	0.289
Cervical to waist (vertical)	0.297	0.159	0.481	0.468
Cervical to crotch	0.583	0.365	0.820	0.696
Axilla height	0.458	0.205	0.572	0.949
Waist to waist over shoulder	0.479	0.359	0.623	0.485
Crotch length	0.565	0.462	0.601	0.315
Wrist span	0.455	0.283	0.441	0.823
Elbow span	0.449	0.293	0.445	0.762
Elbow to wrist length	0.414	0.235	0.394	0.768
Axilla to wrist (vertical)	0.174	0.023	0.192	0.652
Knee fully bent circumference	0.748	0.565	0.646	0.469
Elbow fully bent circumference	0.657	0.585	0.570	0.378

Table 2
THE DIMENSIONAL SPANS OF SOME SUBSIDIARY MEASUREMENTS FOR THREE DIFFERENT SIZE-ROLLS
BASED ON CHEST CIRCUMFERENCE AND STATURE AS CONTROL DIMENSIONS

Size roll	Size	Vertical trunk circumference		Waist circumference		Buttock circumference		Cervical to crotch height		Waist spans		Number of subjects
		Min to Max:	1 to 99 percentile	Min to Max:	1 to 99 percentile	Min to Max:	1 to 99 percentile	Min to Max:	1 to 99 percentile	Min to Max:	1 to 99 percentile	
A	1	20.40	18.61	15.13	24.35	16.13	12.40	16.60	15.87	10.07	13.90	10.43
	2	22.70	18.69	13.05	27.50	19.28	12.39	17.60	15.39	10.84	10.40	8.62
	3	18.20	17.00	13.84	19.56	16.10	14.73	16.60	16.27	10.63	9.40	9.01
	4	26.15	19.88	13.80	23.74	17.73	13.50	17.80	13.19	9.68	15.10	9.63
	5	23.25	19.40	14.29	27.27	19.21	13.76	19.90	15.04	10.16	14.30	9.97
	6	19.60	18.84	14.84	21.19	17.74	13.28	16.50	16.01	10.61	8.70	8.66
B	7	19.65	17.81	14.40	25.00	23.39	14.72	17.30	15.77	10.61	11.30	10.51
	8	19.50	17.37	12.75	23.91	19.36	13.35	22.60	14.28	9.46	10.10	9.35
	9	16.85	16.39	12.50	16.81	16.09	14.69	13.10	14.70	11.40	7.60	7.04
	10	22.65	20.69	12.98	24.34	17.95	14.31	17.60	17.16	10.38	12.20	9.38
	11	23.90	18.77	13.67	26.52	18.81	12.69	16.30	14.61	10.72	14.00	8.78
	12	20.55	18.85	13.05	21.70	19.80	12.93	17.60	16.24	10.68	10.00	9.47
C	13	11.55	11.47	10.41	19.30	10.86	16.93	10.70	10.67	9.70	8.70	8.39
	14	19.45	17.79	12.38	16.30	14.82	12.59	11.00	10.76	9.18	9.10	9.05
	15	21.75	19.83	14.40	27.34	23.00	14.51	18.30	16.02	10.71	14.30	9.87
	16	24.15	19.84	14.42	28.07	23.10	14.53	19.90	14.98	10.64	10.60	9.46
	17	19.35	18.80	13.86	19.64	18.19	13.06	20.90	17.17	10.91	9.70	8.54
	18	19.95	19.70	15.91	29.98	25.97	15.73	14.50	13.59	11.76	11.00	10.67
	19	24.70	19.13	14.25	21.09	20.33	15.07	22.60	19.83	10.23	11.30	9.99
	20	15.55	14.64	11.04	19.21	16.53	14.45	13.40	12.20	10.30	7.60	5.84
	21	22.65	20.42	13.47	17.84	16.60	13.00	17.60	16.94	10.65	12.20	9.79
	22	21.90	19.91	12.25	25.12	18.30	13.38	16.30	14.10	10.17	13.90	9.96
	23	19.70	19.03	13.59	27.50	20.76	11.57	17.60	15.31	11.02	10.40	8.87
	24	16.10	17.09	14.20	19.56	16.50	13.51	16.34	11.34	11.07	9.10	8.84
	25	11.55	11.48	10.83	19.30	17.95	13.24	10.70	10.29	8.69	8.70	8.42
	26	17.55	17.39	11.88	16.01	16.58	12.62	10.80	10.80	7.86	9.10	8.79
	27	21.15	19.65	14.53	27.34	21.69	16.02	17.80	10.74	10.21	13.60	9.37
	28	22.95	20.45	14.48	29.17	22.70	14.38	17.20	16.24	11.03	14.30	10.00
	29	21.55	19.87	13.99	25.36	19.51	14.61	20.80	20.19	10.23	10.70	8.09
	30	18.60	18.12	14.73	18.34	16.13	13.24	17.20	17.30	10.67	9.30	8.49
	31	17.95	17.73	14.00	20.95	20.79	12.90	13.00	12.78	10.93	10.30	10.22
	32	19.40	19.57	14.64	29.98	25.46	16.46	22.60	17.21	10.81	11.50	9.67
	33	23.75	20.21	15.21	20.99	19.63	13.77	16.40	12.60	9.92	11.00	9.91
	34	15.55	14.84	11.87	19.21	18.68	16.25	10.20	10.15	9.37	5.50	5.39

Measurements in centimetres

Table 3SOME SUBSIDIARY BODY MEASUREMENTS USED IN RAE FS(F)4 DIVISION
AIRCREW CLOTHING SIZING PROGRAMMES

Weight
Stature
Chest circumference
Waist circumference
Buttock circumference
Thigh circumference
Vertical trunk circumference
Biacromial breadth
Cervical height
Waist height
Crotch height
Cervical to axilla
Cervical to waist
Cervical to crotch
Axilla height
Axilla to wrist (vertical)
Knee fully bent circumference
Elbow fully bent circumference
Heel-instep circumference

Table 4
**THE EFFECT OF THE SELECTION OF DIFFERENT PAIRS OF GARMENT SIZING CONTROL PARAMETERS
 ON THE RANGES OF SOME SUBSIDIARY DIMENSIONS**

Size Number	Range of recorded subject measurements - castanets									Min Max Range		
	1	2	3	4	5	6	7	8	9	Min	Max	Range
Chest/vertical trunk circumference control												
Stature	160.20-181.90	165.10-190.70	157.60-185.50	162.90-194.10	166.60-193.40	165.00-189.10	162.50-193.50	169.60-200.50	170.60-214.40	21.70	31.20	
Chest circumference	83.30-90.90	83.20-90.90	91.00-98.60	91.00-98.90	99.00-106.90	99.00-106.90	99.00-106.90	99.00-106.80	101.00-114.40	7.40	7.90	
Vertical trunk circ	149.00-155.90	156.00-162.80	150.00-156.90	157.00-163.90	160.00-170.90	156.10-162.90	161.00-169.90	170.00-176.50	168.00-174.90	6.50	6.90	
Height	54.00-70.00	57.00-74.00	58.50-78.50	60.00-82.50	63.00-87.50	67.00-88.50	71.00-95.50	75.80-97.00	80.00-104.00	16.00	24.50	
Cervical height	135.40-156.60	140.80-162.60	134.00-159.90	137.50-168.60	143.10-158.30	141.00-165.70	139.80-167.10	140.00-174.90	146.00-167.10	21.10	31.10	
Crotch height	73.10-93.00	77.10-96.00	71.70-95.00	72.80-100.40	77.00-96.00	76.70-99.20	73.80-97.70	75.40-101.10	78.50-97.20	18.70	28.00	
Arilla to wrist	40.20-53.00	40.60-54.70	38.30-56.30	42.30-56.10	40.90-55.20	40.40-54.80	40.40-54.80	40.40-54.80	41.40-54.20	12.50	19.60	
Waist circumference	66.40-83.40	66.00-91.60	69.00-91.40	68.10-91.20	72.10-93.20	74.00-96.60	79.80-100.10	78.70-108.70	77.00-108.70	17.00	30.00	
Buttock circumference	81.30-97.40	85.90-101.70	88.50-101.80	88.00-105.40	86.26-106.40	94.00-111.40	94.80-109.80	96.50-118.30	100.00-112.50	12.50	21.80	
Number of subjects in Group	104	97	222	494	268	152	309	140	59	Total	1845	
z Total survey popul	5.20	4.85	11.10	24.70	13.40	7.60	15.45	7.00	2.95	Total	92.25	
Stature/chest circumference control												
Stature	165.00-172.90	165.20-172.90	163.00-172.90	173.00-180.80	173.00-180.80	173.00-180.90	173.00-180.90	181.00-189.00	181.00-189.00	7.70	8.00	
Chest circumference	83.20-90.90	91.00-98.80	99.00-106.60	83.30-90.90	91.00-98.90	99.00-106.90	91.00-98.90	99.00-106.90	107.00-114.70	7.60	7.90	
Vertical trunk circ	141.20-161.70	147.40-171.60	145.20-174.30	146.50-163.40	145.20-172.50	153.90-177.70	153.40-177.30	156.80-180.00	161.00-183.20	19.40	24.20	
Height	51.00-68.50	58.50-81.00	65.00-91.60	54.50-74.00	60.00-84.00	67.00-97.00	63.50-87.50	72.00-95.50	88.00-106.50	17.50	30.00	
Cervical height	139.50-150.80	137.90-150.20	141.00-150.10	145.10-156.60	143.90-157.50	146.00-157.20	151.90-164.00	149.80-166.00	154.20-163.40	9.10	14.20	
Crotch height	76.20-91.90	71.70-87.90	73.50-93.00	77.70-91.70	71.50-91.50	82.60-95.70	82.60-95.70	86.60-93.60	9.00	16.20		
Arilla to wrist	40.20-50.80	38.30-53.00	40.40-50.50	42.70-53.00	36.50-54.40	41.80-54.50	44.40-56.30	43.90-55.60	45.50-54.20	9.70	17.90	
Waist circumference	67.30-92.10	71.50-91.40	76.10-98.10	66.00-93.60	68.70-92.50	74.00-100.10	68.10-93.50	78.80-98.80	89.20-103.70	14.50	27.60	
Buttock circumference	85.40-97.60	88.00-103.70	92.00-108.20	85.20-101.70	83.50-105.40	94.00-118.30	86.20-108.40	93.90-114.10	100.70-116.80	12.20	24.30	
Number of subjects in Group	80	227	96	117	506	234	193	36	Total	1807		
z Total survey popul	4.00	11.85	4.80	5.85	23.40	15.30	11.70	9.65	1.80	Total	90.35	
Stature/weight control												
Stature	165.00-172.90	166.20-172.90	173.00-180.90	173.00-180.90	173.00-180.90	181.00-188.40	181.00-188.70	181.00-188.70	181.00-188.70	6.70	7.90	
Chest circumference	82.20-99.40	89.50-107.50	96.00-111.10	84.30-101.60	89.50-111.10	96.20-111.50	85.70-101.20	89.70-104.70	96.50-112.20	15.10	21.60	
Vertical trunk circ	146.30-166.70	147.40-167.20	156.00-174.30	149.00-165.40	151.40-172.30	157.80-177.70	155.40-172.30	158.00-176.20	161.40-180.00	16.40	21.20	
Height	58.00-67.90	68.00-77.50	78.50-87.00	60.00-69.70	70.00-79.60	80.00-89.80	65.00-74.80	75.00-84.50	85.00-94.90	8.50	9.90	
Cervical height	137.90-150.80	139.60-149.80	141.80-150.10	143.90-157.50	143.90-157.50	143.90-157.50	143.90-157.50	143.90-157.50	149.80-166.00	8.30	14.20	
Crotch height	71.70-88.50	74.50-87.90	72.60-86.40	77.70-93.00	78.30-91.20	84.70-95.90	83.70-96.00	82.60-94.80	81.20-94.80	11.20	16.80	
Arilla to wrist	38.30-52.40	39.20-53.00	39.50-50.40	43.50-54.10	36.50-54.40	41.40-54.50	45.30-55.10	44.40-54.80	43.90-55.60	9.40	17.90	
Waist circumference	67.80-92.10	74.40-96.60	80.50-102.00	66.00-93.60	72.10-93.60	77.70-103.30	68.80-85.90	76.00-94.40	82.40-101.70	17.10	23.60	
Buttock circumference	87.30-99.50	92.40-103.60	98.00-108.00	87.60-100.30	92.80-106.50	97.80-111.40	95.90-107.00	99.10-111.40	10.00	15.20		
Number of subjects in Group	159	188	54	248	476	215	223	112	Total	1797		
z Total survey popul	7.95	9.40	2.70	12.40	23.80	10.75	11.15	5.60	Total	89.85		

Table 5
STATISTICAL DATA FOR AIRCREW COVERALL SIZING

NOMENCLATURE	SIZE	NUMBER OF SIZES	STATURE	CUFF CHIN CIRCUMFERENCE	165.00	172.99	172.99	172.99	STATES	
					1st Measurement	2nd Measurement	3rd Measurement	3rd Measurement	1st Measurement	2nd Measurement
Waist Circumference	51.00	165.00	1	85.32	1	85.40	1	85.40	1	85.40
Waist Circumference	52.00	165.00	1	86.30	1	86.38	1	86.38	1	86.38
Waist Circumference	53.00	165.00	1	87.30	1	87.38	1	87.38	1	87.38
Waist Circumference	54.00	165.00	1	88.30	1	88.38	1	88.38	1	88.38
Waist Circumference	55.00	165.00	1	89.30	1	89.38	1	89.38	1	89.38
Waist Circumference	56.00	165.00	1	90.30	1	90.38	1	90.38	1	90.38
Waist Circumference	57.00	165.00	1	91.30	1	91.38	1	91.38	1	91.38
Waist Circumference	58.00	165.00	1	92.30	1	92.38	1	92.38	1	92.38
Waist Circumference	59.00	165.00	1	93.30	1	93.38	1	93.38	1	93.38
Waist Circumference	60.00	165.00	1	94.30	1	94.38	1	94.38	1	94.38
Waist Circumference	61.00	165.00	1	95.30	1	95.38	1	95.38	1	95.38
Waist Circumference	62.00	165.00	1	96.30	1	96.38	1	96.38	1	96.38
Waist Circumference	63.00	165.00	1	97.30	1	97.38	1	97.38	1	97.38
Waist Circumference	64.00	165.00	1	98.30	1	98.38	1	98.38	1	98.38
Waist Circumference	65.00	165.00	1	99.30	1	99.38	1	99.38	1	99.38
Waist Circumference	66.00	165.00	1	100.30	1	100.38	1	100.38	1	100.38
Waist Circumference	67.00	165.00	1	101.30	1	101.38	1	101.38	1	101.38
Waist Circumference	68.00	165.00	1	102.30	1	102.38	1	102.38	1	102.38
Waist Circumference	69.00	165.00	1	103.30	1	103.38	1	103.38	1	103.38
Waist Circumference	70.00	165.00	1	104.30	1	104.38	1	104.38	1	104.38
Waist Circumference	71.00	165.00	1	105.30	1	105.38	1	105.38	1	105.38
Waist Circumference	72.00	165.00	1	106.30	1	106.38	1	106.38	1	106.38
Waist Circumference	73.00	165.00	1	107.30	1	107.38	1	107.38	1	107.38
Waist Circumference	74.00	165.00	1	108.30	1	108.38	1	108.38	1	108.38
Waist Circumference	75.00	165.00	1	109.30	1	109.38	1	109.38	1	109.38
Waist Circumference	76.00	165.00	1	110.30	1	110.38	1	110.38	1	110.38
Waist Circumference	77.00	165.00	1	111.30	1	111.38	1	111.38	1	111.38
Waist Circumference	78.00	165.00	1	112.30	1	112.38	1	112.38	1	112.38
Waist Circumference	79.00	165.00	1	113.30	1	113.38	1	113.38	1	113.38
Waist Circumference	80.00	165.00	1	114.30	1	114.38	1	114.38	1	114.38
Waist Circumference	81.00	165.00	1	115.30	1	115.38	1	115.38	1	115.38
Waist Circumference	82.00	165.00	1	116.30	1	116.38	1	116.38	1	116.38
Waist Circumference	83.00	165.00	1	117.30	1	117.38	1	117.38	1	117.38
Waist Circumference	84.00	165.00	1	118.30	1	118.38	1	118.38	1	118.38
Waist Circumference	85.00	165.00	1	119.30	1	119.38	1	119.38	1	119.38
Waist Circumference	86.00	165.00	1	120.30	1	120.38	1	120.38	1	120.38
Waist Circumference	87.00	165.00	1	121.30	1	121.38	1	121.38	1	121.38
Waist Circumference	88.00	165.00	1	122.30	1	122.38	1	122.38	1	122.38
Waist Circumference	89.00	165.00	1	123.30	1	123.38	1	123.38	1	123.38
Waist Circumference	90.00	165.00	1	124.30	1	124.38	1	124.38	1	124.38
Waist Circumference	91.00	165.00	1	125.30	1	125.38	1	125.38	1	125.38
Waist Circumference	92.00	165.00	1	126.30	1	126.38	1	126.38	1	126.38
Waist Circumference	93.00	165.00	1	127.30	1	127.38	1	127.38	1	127.38
Waist Circumference	94.00	165.00	1	128.30	1	128.38	1	128.38	1	128.38
Waist Circumference	95.00	165.00	1	129.30	1	129.38	1	129.38	1	129.38
Waist Circumference	96.00	165.00	1	130.30	1	130.38	1	130.38	1	130.38
Waist Circumference	97.00	165.00	1	131.30	1	131.38	1	131.38	1	131.38
Waist Circumference	98.00	165.00	1	132.30	1	132.38	1	132.38	1	132.38
Waist Circumference	99.00	165.00	1	133.30	1	133.38	1	133.38	1	133.38
Waist Circumference	100.00	165.00	1	134.30	1	134.38	1	134.38	1	134.38
Waist Circumference	101.00	165.00	1	135.30	1	135.38	1	135.38	1	135.38
Waist Circumference	102.00	165.00	1	136.30	1	136.38	1	136.38	1	136.38
Waist Circumference	103.00	165.00	1	137.30	1	137.38	1	137.38	1	137.38
Waist Circumference	104.00	165.00	1	138.30	1	138.38	1	138.38	1	138.38
Waist Circumference	105.00	165.00	1	139.30	1	139.38	1	139.38	1	139.38
Waist Circumference	106.00	165.00	1	140.30	1	140.38	1	140.38	1	140.38
Waist Circumference	107.00	165.00	1	141.30	1	141.38	1	141.38	1	141.38
Waist Circumference	108.00	165.00	1	142.30	1	142.38	1	142.38	1	142.38
Waist Circumference	109.00	165.00	1	143.30	1	143.38	1	143.38	1	143.38
Waist Circumference	110.00	165.00	1	144.30	1	144.38	1	144.38	1	144.38
Waist Circumference	111.00	165.00	1	145.30	1	145.38	1	145.38	1	145.38
Waist Circumference	112.00	165.00	1	146.30	1	146.38	1	146.38	1	146.38
Waist Circumference	113.00	165.00	1	147.30	1	147.38	1	147.38	1	147.38
Waist Circumference	114.00	165.00	1	148.30	1	148.38	1	148.38	1	148.38
Waist Circumference	115.00	165.00	1	149.30	1	149.38	1	149.38	1	149.38
Waist Circumference	116.00	165.00	1	150.30	1	150.38	1	150.38	1	150.38
Waist Circumference	117.00	165.00	1	151.30	1	151.38	1	151.38	1	151.38
Waist Circumference	118.00	165.00	1	152.30	1	152.38	1	152.38	1	152.38
Waist Circumference	119.00	165.00	1	153.30	1	153.38	1	153.38	1	153.38
Waist Circumference	120.00	165.00	1	154.30	1	154.38	1	154.38	1	154.38
Waist Circumference	121.00	165.00	1	155.30	1	155.38	1	155.38	1	155.38
Waist Circumference	122.00	165.00	1	156.30	1	156.38	1	156.38	1	156.38
Waist Circumference	123.00	165.00	1	157.30	1	157.38	1	157.38	1	157.38
Waist Circumference	124.00	165.00	1	158.30	1	158.38	1	158.38	1	158.38
Waist Circumference	125.00	165.00	1	159.30	1	159.38	1	159.38	1	159.38
Waist Circumference	126.00	165.00	1	160.30	1	160.38	1	160.38	1	160.38
Waist Circumference	127.00	165.00	1	161.30	1	161.38	1	161.38	1	161.38
Waist Circumference	128.00	165.00	1	162.30	1	162.38	1	162.38	1	162.38
Waist Circumference	129.00	165.00	1	163.30	1	163.38	1	163.38	1	163.38
Waist Circumference	130.00	165.00	1	164.30	1	164.38	1	164.38	1	164.38
Waist Circumference	131.00	165.00	1	165.30	1	165.38	1	165.38	1	165.38
Waist Circumference	132.00	165.00	1	166.30	1	166.38	1	166.38	1	166.38
Waist Circumference	133.00	165.00	1	167.30	1	167.38	1	167.38	1	167.38
Waist Circumference	134.00	165.00	1	168.30	1	168.38	1	168.38	1	168.38
Waist Circumference	135.00	165.00	1	169.30	1	169.38	1	169.38	1	169.38
Waist Circumference	136.00	165.00	1	170.30	1	170.38	1	170.38	1	170.38
Waist Circumference	137.00	165.00	1	171.30	1	171.38	1	171.38	1	171.38
Waist Circumference	138.00	165.00	1	172.30	1	172.38	1	172.38	1	172.38
Waist Circumference	139.00	165.00	1	173.30	1	173.38	1	173.38	1	173.38
Waist Circumference	140.00	165.00	1	174.30	1	174.38	1	174.38	1	174.38
Waist Circumference	141.00	165.00	1	175.30	1	175.38	1	175.38	1	175.38
Waist Circumference	142.00	165.00	1	176.30	1	176.38	1	176.38	1	176.38
Waist Circumference	143.00	165.00	1	177.30	1	177.38	1	177.38	1	177.38
Waist Circumference	144.00	165.00	1	178.30	1	178.38	1	178.38	1	178.38
Waist Circumference	145.00	165.00	1	179.30	1	179.38	1	179.38	1	179.38
Waist Circumference	146.00	165.00	1	180.30	1	180.38	1	180.38	1	180.38
Waist Circumference	147.00	165.00	1	181.30	1	181.38	1	181.38	1	181.38
Waist Circumference	148.00	165.00	1	182.30	1	182.38	1	182.38	1	182.38
Waist Circumference	149.00	165.00	1	183.30	1	183.38	1	183.38	1	183.38
Waist Circumference	150.00	165.00	1	184.30	1	184.38	1	184.38	1	184.38
Waist Circumference	151.00	165.00	1	185.30	1	185.38	1	185.38	1	185.38
Waist Circumference	152.00	165.00	1	186.30	1	186.38	1	186.38	1</td	

Table 6

STATISTICAL DATA FOR AIRCRAFT COVERALL SIZING

(All numbers in estimates)

The figure given in the separate column against H_1 , $H_2 + 1$ etc., H_3 , H_4 , $H_5 - 1$ etc., indicates the number of survey subjects having that particular measurement.

Table 7
STATISTICAL DATA FOR AIRCREW COVERALL SIZING

(VII) संस्कृत वाचना के महत्व

Table 8

STATISTICAL DATA FOR AIRCREW COVERALL SIZING

CONTROL MEASUREMENTS 1st STATURE
 CHEST CIRCUMFERENCE 9
 2nd 9
 NUMBER OF SIZES 9
 SIZE 4 CONTROL MEASUREMENT RANGES STATURE 173.00 CHEST CIRCUMFERENCE 83.00 TO 180.99 CHEST CIRCUMFERENCE 90.93 TO 180.99 CHEST CIRCUMFERENCE 90.93

SIZE	STATURE	STATURE								
		1st Measurement	2nd Measurement	3rd Measurement	4th Measurement	5th Measurement	6th Measurement	7th Measurement	8th Measurement	9th Measurement
Min	54.50	1.173.00	3.123.30	1.164.90	1.152.20	1.145.70	1.145.90	1.142.40	1.137.70	1.131.90
Min + 1 Measurement	55.00	1.173.03	3.123.50	1.165.40	1.153.90	1.146.40	1.145.20	1.143.20	1.138.50	1.132.50
Min + 2 Measurement	57.00	2.173.06	3.125.50	1.168.90	1.163.20	1.154.50	1.154.20	1.148.80	1.142.30	1.135.50
Min + 3 Measurement	57.50	1.173.31	3.124.40	1.167.00	1.162.26	1.157.26	1.156.70	1.150.70	1.143.10	1.137.50
Min + 4 Measurement	57.90	1.173.34	3.125.00	1.165.00	1.162.90	1.159.30	1.158.50	1.151.90	1.145.30	1.139.50
1st Percentile	59.59	1.173.80	3.133.47	1.161.07	1.155.31	1.146.20	1.146.26	1.140.27	1.135.13	1.127.29
2nd Percentile	59.34	1.173.90	3.134.31	1.161.59	1.155.99	1.146.20	1.148.01	1.145.43	1.139.53	1.134.56
3rd Percentile	59.51	1.173.92	3.134.55	1.161.90	1.156.63	1.146.30	1.149.15	1.146.53	1.140.45	1.134.68
5th Percentile	59.59	1.173.10	3.125.36	1.161.80	1.157.56	1.151.74	1.149.86	1.146.69	1.146.79	1.145.98
10th Percentile	59.46	1.176.38	3.122.91	1.174.18	2.121.10	5.12.35	1.158.65	1.152.83	1.150.51	1.140.91
20th Percentile	70.33	1.180.14	3.120.57	1.179.54	2.121.26	5.16.76	1.162.92	1.151.88	1.159.12	1.155.57
30th Percentile	70.87	1.180.30	3.120.75	1.180.54	2.121.80	5.17.50	1.163.85	1.162.05	1.159.45	1.155.90
50th Percentile	71.56	1.180.43	3.120.19	1.181.46	2.122.58	5.17.77	1.152.57	1.153.27	1.152.17	1.155.29
70th Percentile	72.91	1.180.42	3.120.24	1.183.09	2.100.92	5.17.27	1.154.42	1.152.23	1.155.95	1.157.82
Max - 4 Measurement	73.30	1.180.10	3.120.20	5.179.56	2.100.55	5.11.30	1.163.90	1.161.90	1.159.40	1.157.30
Max - 3 Measurement	71.98	2.178.20	3.120.30	3.161.20	1.151.20	1.142.20	1.142.00	1.138.30	1.131.10	1.123.40
Max - 2 Measurement	72.38	1.180.30	2.100.30	1.201.20	1.151.30	1.151.30	1.151.30	1.151.10	1.150.30	1.149.40
Max - 1 Measurement	73.18	1.180.52	2.100.30	3.161.40	1.161.20	1.151.00	1.151.20	1.152.30	1.151.30	1.149.40
Max	74.30	1.190.61	2.100.92	3.161.50	1.161.70	1.159.00	1.152.40	1.151.20	1.141.00	1.137.20
Max	14.492	1.176.509	3.161.655	1.176.509	1.176.509	1.176.509	1.176.509	1.176.509	1.176.509	1.176.509
SD	3.784	2.204	1.161.0	3.178.3	3.161.2	3.161.2	3.161.2	3.161.2	3.161.2	3.161.2
Coefficient of Variation	5.867	1.142.2	1.177.2	5.981	3.904	5.238	2.404	4.256	1.574	2.616
No. of Survey Subjects	117	117	117	117	117	117	117	117	117	117

(All measurements in centimetres)

The figure given in the separate column against Min, Min + 1 etc, Max, Max - 1 etc, indicates the number of survey subjects having that particular measurement.

Table 9

STATISTICAL DATA FOR AIRCRAFT COVERAGE SIZING

The figure given in the separate column against Min, Min + 1 etc., Max, Max - 1 etc., indicates the number of survey subjects having that particular measurement.

Table 10

STATISTICAL DATA FOR AIRCREW COVERALL SIZING

STATISTICAL DATA FOR AIRCREW COVERAGE SIZING

STATISTICAL DATA FOR AIRCRAFT SIZING

(All measurements in centimetres)
The figures given in the separate column against this, this + 1 etc., these - 1 etc., indicates the number of survey subjects having that particular

Table 12

STATISTICAL DATA FOR AIRCREW COVERALL SIZING

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Figure given is the separate column against $H_{11}, H_{12} + 1$ etc., Max, Max - 1 etc., indicates the number of survey subjects having that particular measurement.

Table I

STATISTICAL DATA FOR ATBCBHW CENTERWALL SIZING

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Figure 5 gives the separate columns against Min, Min + 1 etc., Max, Max - 1 etc., indicate the number of survey subjects having that particular measurement.

Table 14

PERCENTAGE REJECTION OF SUBJECTS FROM SUB-GROUP SIZE 5 BY THE PROGRESSIVE APPLICATION
OF MINIMUM TO 95TH PERCENTILE LIMITS TO SUBSIDIARY MEASUREMENTS

	Number of subjects left	% rejection
Waist circumference	481	5.3
Buttock circumference	460	9.5
Thigh circumference	443	12.8
Knee fully bent circumference	423	16.7
Vertical trunk circumference	409	19.5
Cervical height	386	24.0
Waist height	371	27.0
Crotch height	349	31.3
Cervical to axilla	334	34.3
Cervical to waist	319	37.2
Cervical to crotch	309	39.2
Biacromial breadth	297	41.5

Population sub-group size 5 on Fig 1 sizing controls:

Chest circumference: 91 cm to 98.99 cm

Stature: 173 cm to 180.99 cm

Number of subjects in sub-group = 508

REFERENCES

<u>No.</u>	<u>Author</u>	<u>Title, etc</u>
1	C.B. Bolton, et al	An anthropometric survey of 2000 Royal Air Force aircrew, 1970/71. RAE Technical Report 73083 (1973) Also published as RAF IAM Report 531
2	R.E. Simpson	Specimen size rolls for aircrew headgear based on an analysis of the head measurements of 2000 Royal Air Force aircrew. RAE Technical Report 74072 (1974)
3	R.E. Simpson C.B. Bolton	An anthropometric survey of 200 RAF and RN aircrew and the application of the data to garment size rolls. RAE Technical Report 67125 (1967)
4	G.M. Morant J.C. Gilson	A report of a survey of body and clothing measurements of Royal Air Force Personnel. RAF Institute of Aviation Medicine, FPRC 633a (1945)
5	M. Alexander J.T. McConville	Revised height/weight sizing programmes for men's protective flight garments. AMRL-TR-79-28 (1979)
6	R.E. Simpson E. Violet Hartley	Scatter diagrams based on the anthropometric survey of 2000 Royal Air Force aircrew (1970/1971) RAE Technical Report 81017 (1981)

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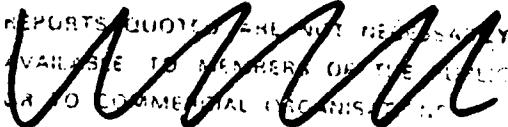


Fig 1

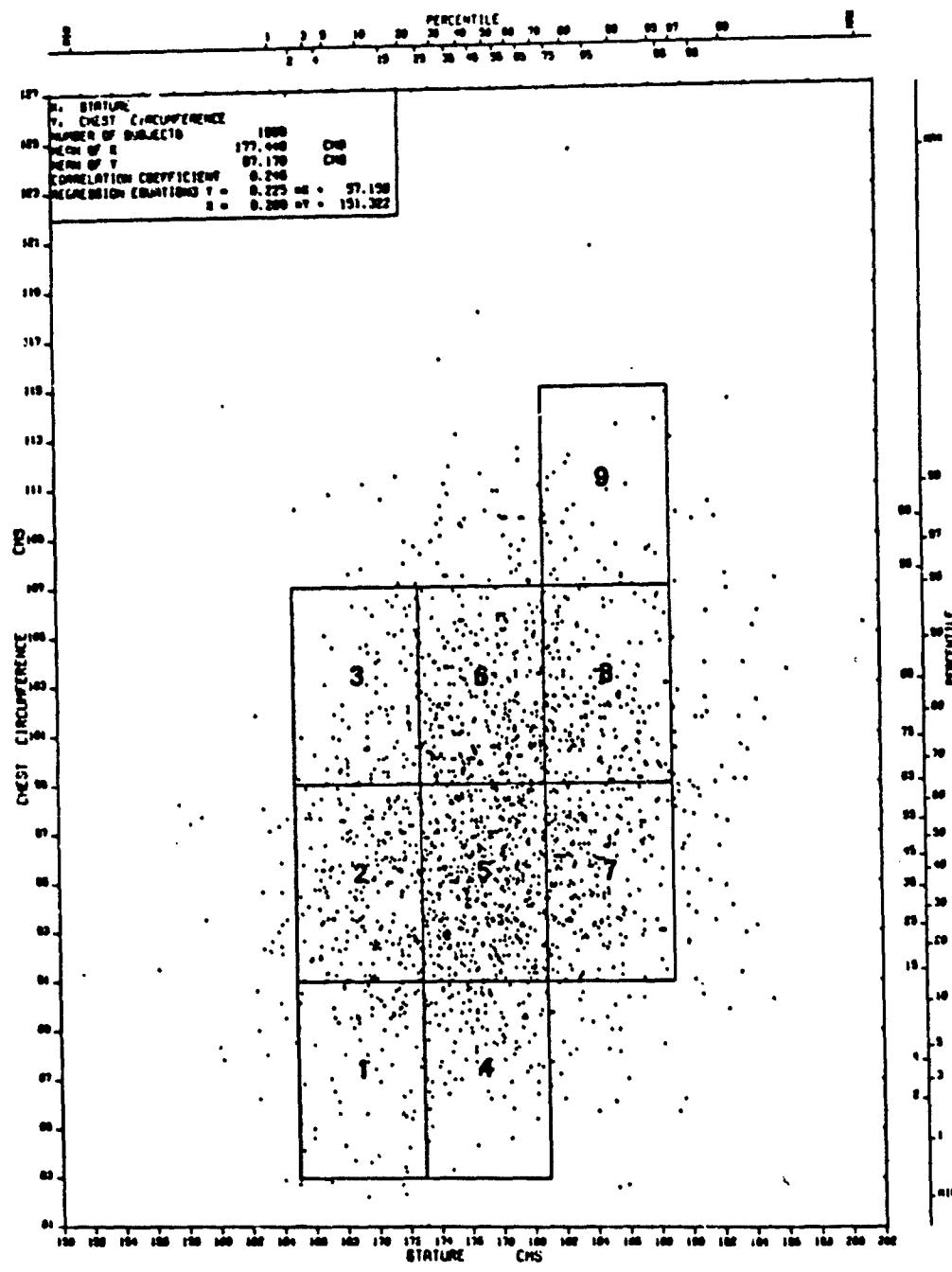


Fig 1

Fig 2

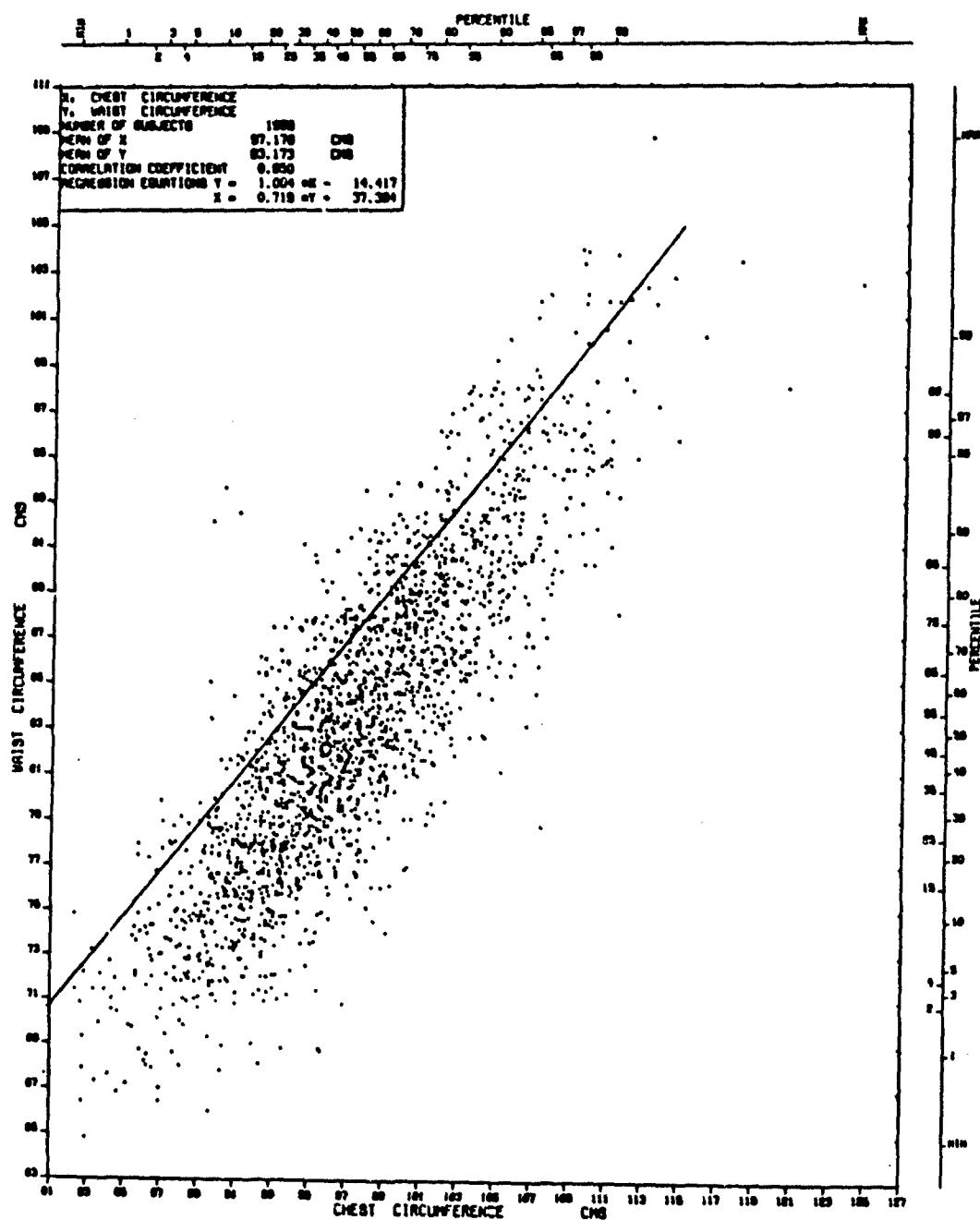


Fig 2

Fig 3

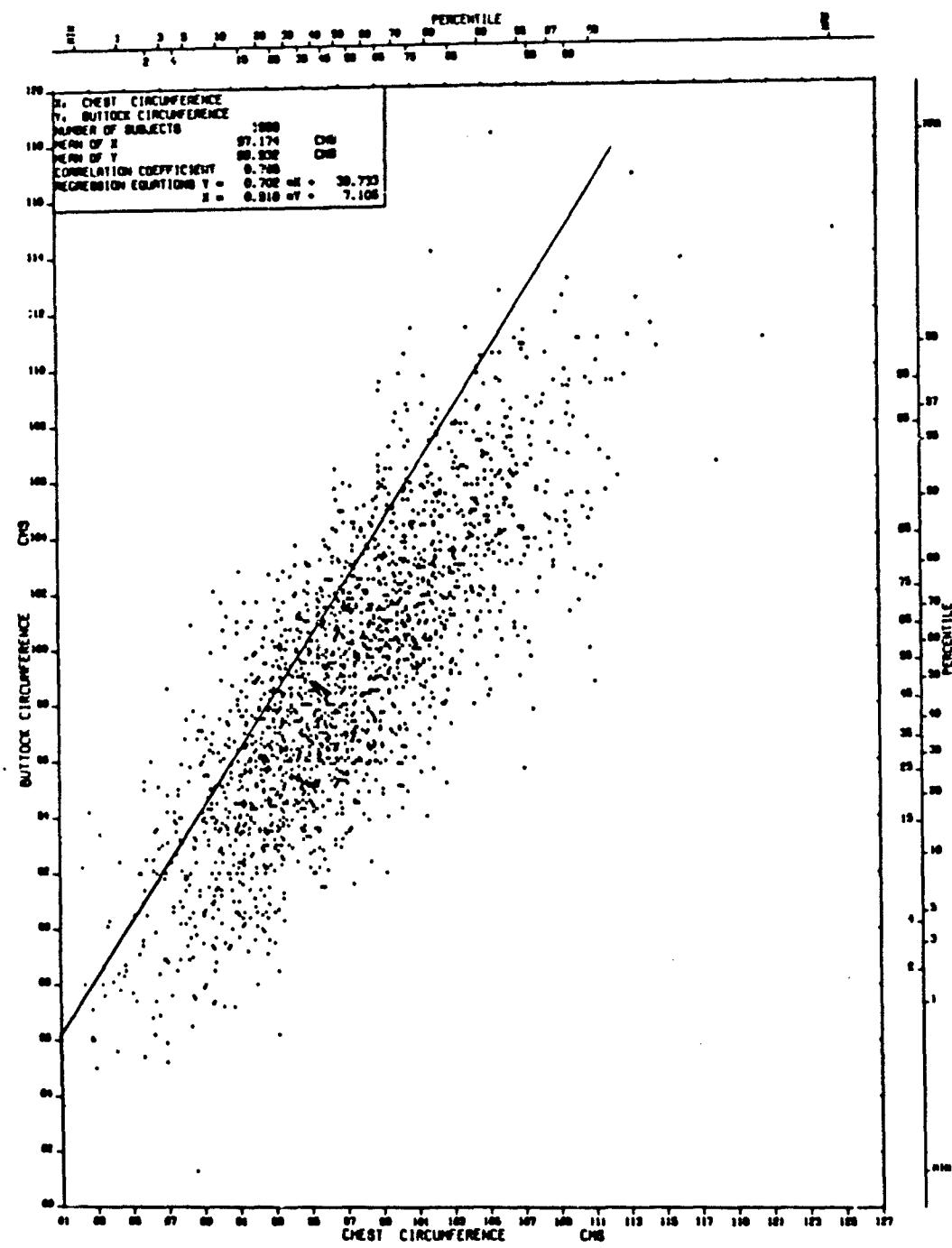


Fig 3

REPORT DOCUMENTATION PAGE

Overall security classification of this page

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17. Abstract Since completion of the 1970/71 anthropometric survey of 2000 Royal Air Force aircrew, the Protective Equipment Section of Flight Systems (Farnborough) Department has made full use of the acquired data to support its advisory role on aircrew protective clothing sizing. Computer analysis of the data has been undertaken to provide sizing information relevant to a variety of garment types and numerically different size-rolls.			
This Report outlines the general approach adopted for the sizing of body-cover garments and headgear. The influences of the choice of control dimensions and subsidiary measurement range limitation upon the size-rolls for aircrew one-piece coverall type garments are discussed.			